

WATER WELL

(No.)

Code 642

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A hole drilled, dug, driven, bored, jetted, or otherwise constructed into an aquifer.

II. Purposes

To provide water for livestock, wildlife, irrigation, human, and other uses.

To provide for general water needs of farming operations.

To facilitate proper use of vegetation on pastures and wildlife areas.

III. Conditions Where Practice Applies

This standard applies only to production wells on lands where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This standard does not apply to:

- monitoring or observation wells;
- piezometers;
- injection wells;
- spring developments;
- pumps installed in wells;
- above ground installations, such as pumping plants, pipelines, and tanks;
- temporary test wells;
- decommissioning of wells.

IV. Federal, State, and Local Laws

Well construction and installation shall comply with all federal, state, and local laws, rules or regulations. The operator is responsible for securing permits if required.

Well installations shall meet the requirements of Wisconsin Administrative Code, Chapter NR 812 - Well Construction and Pump Installation (NR 812). Written approval from the Wisconsin Department of

Natural Resources (DNR) must be obtained prior to the construction of any dug well or for a high capacity well or well system. Well drillers must hold a valid Wisconsin well drilling license. After construction, a well construction report must be filed with the DNR.

V. Criteria

General criteria for design parameters, acceptable installation processes, or minimum performance requirements applicable to all purposes named above:

A. Well Location

1. **Site assessment** - The availability of ground water for its intended use at the site and type of well to be installed shall be determined by a qualified geologist, engineer, or licensed well driller. Determination shall be based on reliable local experience and review of all available relevant geologic maps and reports; well records maintained by state and federal agencies; design construction, and maintenance records of other wells in the area; and an appropriate level of on-site investigation.

The site shall be suitable for safe operation of the drilling equipment.

2. **Well head protection** - Wells shall be located at safe distances from potential sources of pollution, including unsealed abandoned wells. The allowable distance shall be based on consideration of site-specific hydrogeologic factors and shall comply with NR 812.

The well shall be located upslope from any contamination source in accordance with NR 812. If practical, wells shall be located at the highest point on the property.

Wells shall be located a safe distance from both overhead and underground utility lines and other safety hazards.

B. Well Casing

1. **Use of casing** - Casing shall be installed to seal out undesirable surface or shallow groundwater and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic formations may not require casing.
2. **Casing diameter** - Casing diameter shall be sized to permit satisfactory installation and efficient operation of the pump and large enough to assure that uphole velocity is 5 feet per second or less, to protect against excessive head loss.
3. **Strength and Materials** - Casings may be steel, plastic, or other material having sufficient strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing.

Steel or plastic well casings shall meet or exceed requirements specified in NR 812.17, Well casing pipe, liner pipe, and materials.

Only steel well casings shall be used in driven wells and drilled bedrock wells.

To prevent galvanic corrosion, dissimilar metals shall not be joined.

4. **Casing strength** - Well casing wall thickness shall be sufficient to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development, and use. Required casing strength shall be determined as shown in NEH Part 631, Chapter 33, Investigations for Ground Water Resources Development.
5. **Joints** - Joints for well casings shall have adequate strength to carry the load due to the casing length and still be watertight, or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

C. Well Construction

1. **Borehole** - Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.
2. **Well diameter** - The diameter of the well shall be adequate to meet the yield capacity of the formation and to permit the installation of a pump to deliver the needed amount of water to the projected lift elevation.
3. **Screen** - Well screens shall be installed in any aquifer material likely to produce silt or sand in the water. Well screens shall be constructed of commercially manufactured screen sections or well points.

The position of the screen in the well shall be governed by the depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well.

The top elevation of the highest screen or pump intake shall be set below the level of maximum anticipated drawdown.

4. **Seals (packers)** - Telescoped screen assemblies shall be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.
5. **Filter Pack** - Installation of a filter pack around the well screen shall be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer, such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; a requirement for maximum yield from a low-yielding aquifer; and holes drilled by reverse circulation.
6. **Prepacked well screens** - For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial prepacked well screen may be substituted for a conventionally installed (by tremie) filter pack.
7. **Installation** - Casing shall extend from above the ground surface down through

unstable earth materials to a depth of at least 2 feet into stable material or to the top of the screen.

All wells shall be cased to a sufficient height (minimum of 12 inches) above the finished ground surface to prevent entry of surface and near-surface water.

Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.

If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

8. **Grouting and sealing** - The annular space surrounding the permanent well casing shall be filled with neat cement grout, concrete grout, sodium bentonite water slurry, or clay slurry in accordance with NR 812.20 - Grouting and sealing.

D. Finishing Operations

1. **Well development** - All wells shall be developed until the water is practicably clear and free of sand in accordance with NR 812.22 - Finishing operations.

The method of well development shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen installed.

2. **Aquifer development** - For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Development techniques must be in accordance with NR 812. Prior approval from DNR is required for blasting or hydrofracturing of high capacity wells.
3. **Disinfection** - Wells shall be disinfected immediately following construction or repair to neutralize contamination from equipment, material, or surface drainage introduced during construction. The

disinfection process shall comply with NR 812.22 - Finishing operations.

4. **Water quality testing** - The well shall be sampled for coliform bacteria upon completion of the well and upon completion of the pump installation. If the well driller is also the pump installer, the sample may be taken following the completion of the pump installation.
5. **Access Port** - An access port with a minimum diameter of 0.5 inch shall be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable well caps are acceptable as access ports.

VI. Considerations

Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice, but are not required to ensure its basic conservation function are as follows:

- A. The potential for adverse interference with existing nearby production wells should be evaluated in planning.
- B. The potential for ground water overdraft and the long term safe yield of the aquifer should be considered in planning.
- C. Gravel pack - Installation of a gravel pack around the well screen should be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer, such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; holes drilled by reverse circulation and recommended for maximum yield from a low-yielding aquifer.
- D. Potential effects of installation and operation of the well on cultural, historical, archeological, or scientific resources at or near the site should be considered in planning.
- E. The well water should also be analyzed for the presence of nitrates and triazine prior to putting the well into service.

VII. Plans and Specifications

Plans and specifications for wells shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

VIII. Operation and Maintenance

A plan for maintenance shall be prepared. The well construction records shall be kept on file with the maintenance plan by the owner/operator. As a minimum, the maintenance plan shall include a statement of identified problems, corrective action taken, date, and specific capacity (yield per unit drawdown) of well before and after corrective action was taken.

IX. References

Wisconsin Administrative Code, Chapter NR 812, Well Construction and Pump Installation, Department of Natural Resources.

National Engineering Handbook (NEH), Part 631, Chapter 33, Investigations for Ground Water Resources Development.